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ABSTRACT

Some criticisms of high school have been concerned with what organizational theorists call operations technology. Broadly, technology refers to the work an individual teacher or the school's collective professional staff does with or for students, the school's "raw material." Technology can be studied more closely by separation into three aspects--operations, materials, and knowledge--with each aspect potentially distinguished by classroom-level and school-level attributes. The National Institute of Education/National Association of Secondary School Principals Survey of Public Secondary School Principals applies primarily to operations technology and a few indicators of materials technology. Overall, no clear pattern emerged enabling one to identify schools with a generally complex operations technology or schools with simpler operations technology. This absence of a unifying construct should be recognized as the analysis of the survey proceeds. While limited in their applicability to the most complex practices within schools, the results of the survey lay the groundwork for intensive research into classroom-level technological complexity and elaboration of the concepts of technology at the school level. (Author/IRT)

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Ellen Tenenbaum June 1978
National Institute of Education

A FIRST LOOK AT SECONDARY SCHOOL TECHNOLOGY

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INTRODUCTION

One of the prevalent criticisms of high schools have been directed toward the operation of their programs. Critics contend that high schools are insensitive to the diverse needs and preferences of their students. High schools are accused of two types of unresponsive behavior:[1]

1. Imposing too many standardized academic requirements for promotion and graduation; lacking flexibility in opening up other options for earning credits or providing more personally relevant courses and programs; and

2. batch-processing students through inflexible yearly and daily scheduling systems; evaluating and generally treating students impersonally.

Both accusations concern what organizational theorists call operations technology. The first pertains to the instructional program of the high school, and the second refers to how the instructional program is organized.

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[1] See for example M. Timpane, S. Abramowitz, S. Bobrow, A. Pascal, Youth Policy in Transition, Rand, June 1976. This report synthesizes the criticisms and recommendations of three studies: (1) Youth: Transition to Adulthood by the President's Science Advisory Committee, 1974, (2) The Education of Adolescents by the National Panel on High Schools and Adolescent Education, and (3) The Reform of Secondary Education, National Commission on the Reform of Secondary Education, 1973.

To correct the situation, the critics propose the following reforms of high school programs and their organization:

Program

- o Modernize the curriculum;
- o Open up workplace and community-based educational alternatives outside the high school itself, to make youth aware of their opportunities, motivated toward personal growth and more integrated with other age groups;
- o Individualize instruction to better meet the needs of diverse students.

Program organization

- o Adopt more flexible scheduling and student-evaluation arrangements, again to be more responsive to individual needs.

These allegations and prescriptions, however, stand on very little evidence. One purpose of the NIE/NASSP Survey of Public Secondary School Principals was to assess the accuracy of some of these claims and the appropriateness of some of the recommendations.

Theoretical Background

Organization theorists use the term "technology" to refer to the means through which an organization accomplishes its goals. There is no single widely accepted definition of technology. A restricted definition including only physical materials or machinery is too narrow a concept of technology to be useful or realistic in the analysis of work organizations in general

or schools in particular. According to Corwin,

> "disappointingly little attention has been given to technology-related problems in educational organizations. Perhaps one reason for the neglect is an apparently widespread belief that. . . . There is no standardized way of dealing with the variety of problems (teachers) confront." [2]

Corwin borrows concepts of industrial and commerical technology and seeks their applicability to schools. For example, Woodward proposes three basic types of technology in industrial organizations -- unit and small-batch technology, large-batch process, and mass or assembly processes.[3] Corwin likens these, respectively, to individualized instruction, ability grouping, and large-scale processing of undifferentiated students from class to class.[4]

As another example, Thompson identifies three types of technologies.[5] Long-linked technology involves serial interdependence, in which one process depends on a prior process. Corwin likens this to the necessity of mastering subtraction before long division can be learned. The mediating technology requires operating in standardized ways with differentiated clients -- in schools Corwin cites standard curriculum guides. Finally, the intensive technology calls for using differentiated techniques with a single client -- in schools, individualized instruction would be implied.[6]

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[2] Ronald Corwin, "Models of Educational Organizations," Review of Research in Education, 2, 1974, p. 283.

[3] Joan Woodward, ed., Industrial Organization: Behavior and Control, Oxford University Press, 1970.

[4] Corwin, op cit, p. 282.

[5] James D. Thompson, Organizations in Action, McGraw-Hill, 1967, p. 54.

[6] Corwin, op cit, p. 283.

Corwin concludes that wide variations exists in the technologies used in schools, and the concept of technology in schools is likely to be more sophisticated and many-faceted than previously assumed.

The concepts of secondary school technology used in this paper derive from the work of two other groups of authors:

(1) Perrow defines technology very broadly as "the work done on raw materials," "actions that an individual performs upon an object. . . to make some change in that object."[7] The object or raw material may be animate or inanimate. The individual's state of knowledge (a) about the raw material (its complexity, stability, variability) and (b) about how to work with it determines the technology that will be used. If a raw material is perceived to be simple to understand, stable and uniform, the resulting technology is likely to be routine with significant control over the raw material and its processing. On the other hand, Perrow believes, if one's knowledge about the raw material is limited and one perceives it to be variable or unstable, the technology will be nonroutine and will have to deal with many exceptional cases.

(2) Hickson, Pugh and Pheysey selectively synthesize the work of Thompson, Woodward, Perrow and others into three basic aspects of technology: [8]

a. Operations technology, or "the equipping and sequencing of activities in the workflows."

b. Materials technology, or "the materials used in the workflows."

c. Knowledge technology, or the state of knowledge, as borrowed from Perrow.

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[7] Charles Perrow, "A Framework for the Comparative Analysis of Organizations," American Sociological Review, Apr. 1967, p. 195.

[8] David J. Hickson, D.S. Pugh and Diana C. Pheysey, "Operations Technology and Organization Structure: An Empirical Reappraisal," Administrative Science Quarterly, Sept. 1967, p. 380.

The three aspects of technology described in Hickson et. al. are applicable to schools. Operations technology would include varieties of instructional programs, and their organizational arrangements (such as scheduling and grading systems). Materials technology would include curriculum materials, books, and other physical resources and facilities. Knowledge technology would refer to the level of professional staff knowledge of the teaching and learning process and of their students.

A combination of the works of Perrow and Hickson, et. al. form the basis of this paper's discussion of technology. Broadly, technology refers to the work an individual teacher or the school's collective professional staff does with or for students, the school's "raw materials." Technology can be studied more closely by separation into the three aspects of operations, materials, and knowledge, with each aspect potentially distinguished by classroom-level and school-level attributes.

In the Survey of Public Secondary School Principals we examine primarily operations technology and a few indicators of materials technology. It is impossible through a mail survey to ascertain the detailed nature of a teacher's knowledge of the teaching and learning process or an administrator's knowledge of school governance and clientele. For this reason the high school survey focuses on the more easily ascertainable facets of technology -- operations and materials.

OPERATIONS TECHNOLOGY

Two logical components that make up operations technology are:

(1) the programs, curriculum offerings and services the high school provides; and

(2) the way in which these programmatic offerings are scheduled, timed, or otherwise organized.

The program and organizational components of operations technology can be studied at both the school and classroom levels. Thus, operations technology may be depicted as follows:

Figure 1: Operations Technology

	Program	Program Organization
School-level		
Classroom-level		

The items used in the high school survey to describe secondary school operations technology fall within three of the four cells of this matrix as illustrated in Figure 2:

Figure 2: Operations Technology

	Program	Program Organization
School-level	o Array of traditional courses o Array of nontraditional courses o Alternatives for earning credit o Early exit or early graduation options o Array of programs serving special needs	o Course-length scheduling alternatives used o Daily scheduling alternatives used o Grading systems used
Classroom-level	o Presence of ability grouping in 11th & 12th grade classes o Presence of individually-paced learning o Presence of diagnostic-prescriptive education o Presence of remedial reading or math o Presence of bilingual instruction	

As the diagram suggests, we have more information from participating principals about school-level programs and management than about what occurs in classrooms. Knowledge about classroom-level variables from this survey is limited, as principals may not be informed as to the extent of these complex activities. It is most appropriate to measure the extent of complex classroom practices from teacher responses,[9] as will be done in a follow-up survey. Furthermore, it may not be appropriate to assume that technological complexity is uniform throughout the school.[10] With these limitations in mind, the survey results are described and the degree of association among technological variables are examined.

School-level Programs

Traditional Courses

Virtually all schools require all 10th and 11th grade students to take a full year of English. However, only 65% of the schools require all seniors to do so.

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[9] Elizabeth Cohen, Terrence Deal, John Meyer and W. Richard Scott, Technology and Structure in the Classroom , report conducted under NIE grant NE-C-003-0062, Environment for Teaching Program, Stanford University, January 1977.

[10] Sanford M. Dornbusch and W. Richard Scott, Evaluation and the Exercise of Authority, Jossey-Bass, 1975.

Apart from English, a comprehensive sampling of 12 "traditional" courses were listed on the questionnaire,[11] and principals checked those which were taught at their schools. The results, shown in Table 1, indicate that nearly all schools offer a core of courses, and beyond these, a moderate offering of other traditional courses.[12]

TABLE 1: TRADITIONAL COURSES

	Percent of Schools
Biology	99
Business education	99
Chemistry	98
Homemaking	98
Physics	93
Wood or machine shop	89
Art	88
French	70
Auto mechanics	57
Calculus	54
Latin	27
Russian	4

[11] Certain courses, such as U.S. History or social studies, were not included, assuming virtually all schools teach them. Courses listed were those on which we expected some variance among schools.

[12] Additionally, 90% of the schools teach a math sequence through grade 12.

Most schools include nine or ten of these courses in their curricula--all the "core" courses plus two or three of the latter five. Discounting the rarely-offered Russian, only about 10 percent of the schools teach all the listed traditional courses. However, two-thirds of the schools teach at least ten of them.

It is interesting to compare some of our findings with James B. Conant's 1967 study, The Comprehensive High School.[13] Conant reported on the courses taught in 2000 "medium-sized" comprehensive high schools (enrollment of 750-1999).

- Calculus appears to be a more prevalent subject today than ten years ago: 54 percent of our respondent schools offer calculus, while in 1967, 40 percent of Conant's sample offered it.

- Foreign languages occupy a lesser position in the academic curriculum today than they did a decade ago. Seventy percent of our participant schools offer French. Ten years ago, Conant reported French taught in 93 percent of the schools in his study. The teaching of Latin has declined markedly. In 1967, 38 percent of the schools studied by Conant taught four years of Latin. Today, only about one-fourth of the schools teach any Latin.

- While vocational education was offered in the great majority of high schools ten years ago, today such courses are even more

[13] James B. Conant, The Comprehensive High School, McGraw-Hill, 1967.

universally offered, as the percentages for selected courses below indicate.

	Conant Study (1967)	NIE/NASSP Study (1977)
Business education	92%	99%
Home economics	90%	98%
Auto mechanics	52%	57%
Machine/wood shop	Not reported	89%

Non-traditional Courses

Over the past decade, movements to modernize the high school curriculum brought new courses into many schools. Eight "nontraditional" courses were listed on the questionnaire, and principals noted which ones are taught as full courses in their schools. The results are described in Table 2.

TABLE 2: NONTRADITIONAL COURSES

	Percent of Schools
Sociology, anthropology or psychology	77
Consumer education	60
Family life (sex) education	36
Career exploration	28
Environmental studies	27
Ethnic studies	17
Values clarification/moral education	7
Women's studies	

Nearly all schools (92%) offer at least one of these courses, but very few teach more than four. A school typically offers two or three of the eight listed.

Alternatives for Earning Credit

Schools may allow students to receive academic credit in a variety of ways. According to the survey, nearly two-thirds of the respondent schools offer off-campus work experience or occupational training. Independent study projects and college work on a college campus are also options at most schools. Table 3 summarizes the principals' responses to the question: "Which of the following programs are currently available to your 9th to 12th grade students for credit?"

TABLE 3: CREDIT ALTERNATIVES

	Percent of Schools
Work experience or occupational training	65
Independent study projects	60
Correspondence courses	54
College courses on a college or university campus	53
Night or adult school	41
Credit by contract	23
College-level courses given at your school	19
Credit by examination	17
Community volunteer work	14
Travel	8

Nearly all schools (95%) have at least one of the options listed, and four-fifths provide from one to five. Very few (10%) have more than five. The typical school offers three of the alternatives.

The degree to which students participate in off-campus programs such as those listed above is suggested by the principal's response to the question:

> About what percent of 11th and 12th grade students are engaged in programs (work experience, community service, college courses, etc.) such that they are not physically present at your school full time?

According to the respondents, only about 9 percent of 11th graders and 16 percent of 12th graders are off-campus part of the time. However, four schools out of five schools report at least some 11th graders off campus, and 92 percent of the schools have at least some seniors off-campus pat of the time.

School-level Programs Serving Special Needs

Principals were asked whether their schools offer certain programs, apart from credit alternatives, designed for students with particular needs. Responses are as follows:

TABLE 4: SCHOOL PROGRAMS SERVING SPECIAL NEEDS

	Percent of Schools
Early graduation	65
College advanced placement	40
Job placement service	36
Dropout prevention program	19
Early exit by examination (For diploma or equivalent)	10

CLASSROOM-LEVEL PROGRAMS

Certain programmatic components of operations technology are centered within the classroom and are thus distinguished from school-wide programs in which the student typically may elect to participate. The high school survey focussed on classrcom level programs serving the special learning needs of individuals.

TABLE 5 : CLASSROOM-LEVEL PROGRAMS

	Percent of Schools
Remedial reading or math	87
Ability grouping	48
Individually-paced learning	23
Diagnostic-prescriptive education	11
Bilingual instruction	11

As Table 5 indicates, most schools teach remedial basic skills, and the principals' responses to a separate item indicate that an average of 10 percent of students are in remedial programs. Among the five classroom-level programs that address particular learning needs, most schools (71%) have one or two, and only 6 percent of the respondents report having none.

Another approximation of the extent to which high schools serve individuals with particular needs is available from a measure of the school's external environment - the variety of federal or state funding schools receive.

While not treated as a technology variable per se in the analysis of the high school survey, the variety of funding for special programs suggests programmatic complexity in the school's operations technology. As Table 6 indicates, nearly all schools have at least three of the funding programs and The average school receives funding from six of the twelve sources.

TABLE 6: SOURCES OF FEDERAL OR STATE PROGRAM FUNDS

	Percent of Schools
Free or reduced-price lunch program	92
Vocational education	85
Special education (including handicapped)	80
Student transportation	72
Federal Title I (ESEA)	69
Library programs	62
Career education	36
Title IV-C-innovative programs (old Title III)	36
State Compensatory Education	24
Bilingual education	12
ESAA (desegregation)	9
Assistant to Indochinese Refugee Children	8

Several questions in the survey tapped the degree to which students in the school could obtain remedial services, job-oriented services or college-level work. For a general indication of the extent to which schools serve differentiated clientele, we grouped the indicators into three categories: college-oriented, job-related, and remedial. (The number

following each indicator represents the percent of schools offering that particular service.)

- o College-oriented services: College advanced placement (40%), or college-level courses available to high school students, either on a college campus (53%) or at the high school (19%).
- o Job-related services: Work experience or occupational training (65%) or presence of a job placement service (36%).
- o Remedial services: Whether any 10th-to-12th grade students are taking remedial work in either English (76%) or math (68%).[14]

The findings summarized in Table 7 reveal that almost half the schools (47%) have programs for all three groups of students. Thirty-two percent serve two groups, usually the job-oriented and those needing remedial work. In about one-third of the schools there are no college-level work programs, and about one-fourth lack the job-oriented programs listed. In sum, the great majority of schools (79%) operate specific programs for at least two of the three groups.

[14] Taken as a whole, college-oriented services are offered in 68% of the respondent schools. 73% have job-related services; 87% have remedial services.

TABLE 7: THREE TYPES OF NEED-BASED PROGRAMS

	Percent of Schools
Remedial, Job-oriented and college oriented	47
Remedial and Job-oriented only	15
Remedial and college-oriented only	9
Job- and College-oriented only	8
At least two of the three	79
Remedial only	8
Job Oriented only	4
College oriented only	4
None	6

Summary

With regard to the program aspect of operations technology in secondary schools, particularly at the school level, this survey suggests that there is considerable diversity across high schools with respect to the particular array of programs and services offered. Few schools in the sample provide a large number of alternatives. However, most schools teach at leat a few nontraditional courses, offer several non-classroom channels for earning credits, and provide a considerable number of special-need programs and services.

OPERATIONS TECHNOLOGY: PROGRAM MANAGEMENT

Items from the high school survey included in the organizational/managerial component of operations technology basically inquired about how the instructional program is arranged. This included asking about the following:

- Course-length scheduling alternatives (e.g., semesters, trimesters, mini-courses)
- Daily period-length scheduling alternatives
- Grading alternatives

According to the principals sampled, nearly all schools (87%) organize their year by the traditional semester system, and the majority use only semesters.[15] Although quarter-length courses were marked by one-third of the principals, many of these cases merely represent a subdivision of the basic semester system. Among the other options from which principals could select--trimesters, mini-courses, year-round variant, or ther (specify)--the only alternative used in a substantial number of schools in a supplementary use of mini-courses in 12 percent of the schools.

Virtually all schools (95%) use the traditional 35-60 minute period for daily scheduling. Among the other options from which principals could select--modules, block (periods lasting two hours or longer), flexible, daily demand, or other (specify)--block scheduling, used by 18 percent of the schools as supplementary method, is the only alternative used in a significant number of schools.

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[15] The two questions relating to course-length scheduling and daily period length scheduling were similarily phrased. For each, principals were asked to note the systems used in their schools by placing a "1" beside the dominant system and "2" beside others in operation.

In the area of evaluating student performance, 14 different grading systems were listed, and principals checked those which are used in their schools. The results by method are presented in Table 8 to illustrate the great variety of grading systems available.

TABLE 8: METHODS OF EVALUATING STUDENT PERFORMANCE

	Percent of Schools
1. A-B-C-D-F	84
2. Pass-fail	34
3. Numerical	21
4. Conferences	13
5. Weighted (additional value for more difficult courses)	12
6. Percentages	8
7. Pass-withdraw	5
8. Written narrative evaluations	5
9. Continuous progress	4
10. Verification of competency	4
11. Checklist of objectives	3
12. Dual (student chooses grading system	2
13. Self evaluation	1
14. No grade reports	--

Although some schools have implemented one or more nontraditional methods of grading, letter grades are still the most widely-used method of reporting student progress. About half the schools use only the traditional grading

systems of A-B-C-D-F, numerical or percentage-based grades. The other half use both traditional and alternative methods. Cross-tabulations indicate that nearly all schools using pass-fail or pass-withdraw (36%) use these methods in conjunction with or supplemental to a traditional system. Only one percent of the participant schools do not use a traditional grading system.

Change

Principals were asked whether certain programmatic, managerial and structural changes had occured in their schools over the past five years. Table 9 lists the proportion of principals noting an increase, decrease or no change in instructional programs and their management.

Besides the striking increase in programmatic emphasis upon basic reading, writing and math skills, the majority of schools have increased the number of electives in the curriculum and the range of credit alternatives for meeting course or gradiation requirements. On the managerial side, the range of alternative grading systems has remained largely unchanged over the past five years.

TABLE 9 : CHANGE

In the past five years, have the following increased, decreased, or stayed about the same in your school? (Check one item per line)

	Decreased	Stayed about the same	Increased
Number of required courses	7	58	35
Number of elective courses	8	29	64
Student alternatives for meeting course or graduation requirements	1	48	51
Emphasis upon basic reading, writing and math skills	1	21	78
Range of alternative grading practices	3	84	14

In general, the survey suggests that in the program area, schools have a considerable variety of courses, services and options for students. The criticisms that schools impose too much curricular standardization and lack flexibility are not borne out by this study. However, inflexibility in the managerial settings of instruction appears to find support in the survey results. The emerging picture of secondary school operations technology seems to be one of considerable program diversity within limited and fairly inflexible managerial bounds.

MATERIALS TECHNOLOGY

Materials technology refers to the physical materials used in the workflow of an organization. In schools this would include curriculum materials, physical facilities, such characteristics as flexible-wall arrangements, books, media and any other material resources.

The high school survey has one indicator of materials technology: the variety of special facilities schools have (or have access to).

TABLE 10 : PHYSICAL FACILITIES

	Percent of Schools
Remedial reading or math lab	67
Media production facilities	54
Occupational training center	47
Resource center for teachers	40
Indoor lounge or commons for students	39
Departmental offices	39
Career information center	39
Alternative school or alternative school program	37
Subject area resource center other than library	34
Child care or nursery school facility	20

Most schools have labs for remedial work, and over half have facilities for radio, film or television production as the data in Table 10 shows. Nearly half the schools provide access to an occupational training center. In general, nearly every school (95%) has at least one of the facilities listed, and most (58%) have four or more.

Correlations

Nonparametric (Kendall) correlations were computed for the technology variables. Results of specific interest are discussed below and a complete correlation matrix appears in the appendix. The components of operations technology are examined first, followed by associations between the operations and materials technology variables.

Regarding operations technology, correlations maong the school-level program variables indicate moderate levels of association, as shown in Table 11 . Schools with diversity along one programmatic line are also like to demonstrate variety along other lines.

TABLE 11: CORRELATIONS AMONG SCHOOL-LEVEL PROGRAM VARIABLES

	Nontraditional courses	Credit alternatives	Early exit options	Job placement - dropout prevention
Traditional courses	.22	.29	.23	.21
Nontraditional courses		.26	.18	.19
Credit alternatives			.33	.24
Early exit options				.18

Correlations among those classroom-level variables tapped in the survey, however, show them to be weakly associated with one another, except for a noticeable association between individually-paced learning and diagnostic-prescriptive education (see Table 12). One explanation for this association may be that diagnostic-prescriptive education is based on the formulation of an individualized learning plan for each student involved. A school that goes to some length to diagnose an individual's needs is likely to have the student proceed at one's own pace.

TABLE 12: CORRELATIONS AMONG CLASSROOM-LEVEL PROGRAM VARIABLES

	Individually-paced learning	Diagnostic-Prescriptive education	Remedial reading or math	Bilingual instruction
Ability grouping	.09	.07	.14	.05
Individually-paced learning		.33	.02	.10
Diagnostic-prescriptive education			.06	.13
Remedial reading or math				.06

Correlations between the program and managerial variables, shown in Table 13, suggest only modest relationships. A school's course offering diversity is related to a small extent to the variety in program organization, especially so for grading arrangements. The low correlations most likely reflect the lack of variance across schools in the managerial component of their operations: schools simply use conventional scheduling and grading mechanisms. On the other hand, programs demonstrate considerable diversity and variance among schools.

TABLE 13: PROGRAM-MANAGERIAL CORRELATIONS

School-level Programs	Course-length Scheduling	Daily Scheduling	Grading Systems
Traditional courses	.17	.14	.18
Nontraditional courses	.14	.13	.16
Credit alternatives	.14	.16	.24
Early exit options	.08	.07	.12
Job placement-dropout prevention	.03	.13	.15
Classroom-level Programs			
Ability grouping	.10	.11	.15
Individually-paced learning	.05	.09	.16
Diagnostic-prescriptive education	.05	.10	.13
Remedial reading or math	.02	.06	.04
Bilingual instruction	.01	.06	.07

The strongest bivariate correlation is between a school's range of credit alternatives and its variety of grading methods. A school that offer several non-classroom alternatives for earning credit may need to fashion alternative ways of evaluating student performance in these programs.

In general, the weakness of association between the programmatic and organizational components of operations technology illustrate their separate existences: operations technology is not necessarily a unitary construct.

Correlations between the number of different types of facilities, our sole indicator of materials technology, and the operations technology variables, appear in Table 14.

Table 14 : Correlations Between Number of Facilities (Materials Technology) and Indicators of Operations Technology

OPERATIONS	Materials Technology Correlation coefficient
Programs:	
School-level	
Traditional courses	.21
Nontraditional courses	.15
Credit alternatives	.25
Early exit options	.17
Job placement/dropout prevention	.17
Classroom-level	
Ability grouping	.11
Individual-paced learning	.18
Diagnostic-prescriptive education	.12
Remedial reading or math	.09
Bilingual	.15
Organization:	
Course-length alternatives	.09
Daily scheduling alternatives	.19
Grading alternatives	.16

The clear association between the different program types and the number of specialized facilities available suggests that schools desiring to open up nonclassroom alternatives need corresponding "outs" for those programs. It would be difficult to have a substantial occupational training program without access to an occupational training centers. Schools with a variety of program alternatives are likely to have stretched beyond the physical plant -- through their own iniative or with district or other aid.

Conclusion

A question of theoretical importance is: "Are some schools more technologically complex than others?" With regard to operations technology, the survey results suggest that there does not appear to be a unifying concept of technological complexity in secondary schools. The more programmatic aspects of the school-level operations technology, however, seem to co-vary to a moderate extent.

Overall, no clear pattern emerged enabling one to identify schools with a generally complex operations technology or schools with a simpler operations technology. This absence of a unifying construct should be recognized as the analysis of the high school survey proceeds. When examining the associations between technology and school structure or technology and the school's external environment, for example; the various aspects and subcomponents of technology must each be considered separately.

These results and the measures themselves are based only on the principals' reports of classroom-level practices. The principal is likely to be better-informed about school-level programs than about what occurs within classrooms. School-level data generated by this survey may be more accurate than classroom-level data. The principal is less likely aware of complex individualized instructional techniques used by teachers. An additional limitation is the small number of items on which the results are based. Finally, a single mail survey cannot capture the complexities of technology at either the classroom level or the school level. Therefore, follow-up surveys are planned with teachers in a subsample of the respondent schools, and in-depth case studies of 15-20 schools will be conducted to capture more of the nature of technology in secondary schools.

The results of the Survey of Public Secondary School Principals, while limited in their applicability to most complex practices within schools, do lay the groundwork for intensive research into classroom-level technological complexity and elaboration of the concepts of technology at the school level. In the follow-up surveys with teachers, counselors and students, and especially in the case studies of selected schools, more investigation into the nature of the three types of technology will take place. From this research a clearer conceptualization of technology as it applies to schools will emerge. Furthermore, criticisms of school practices that are linked to technology can be better evaluated.

APPENDIX: NONPARAMETRIC CORRELATIONS AMONG TECHNOLOGY VARIABLES

		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	TR Courses	.22	.29	.23	.21	.27	.13	.12	.09	.15	.17	.14	.18	.21
(2)	NT Courses		.26	.18	.19	.07	.14	.12	.07	.14	.14	.13	.16	.15
(3)	Credit Alts			.33	.24	.13	.22	.19	.14	.18	.14	.16	.24	.25
(4)	Early Exit Options				.18	.10	.19	.19	.21	.21	.08	.07	.12	.17
(5)	Job Place-Dropout Prev.					.15	.25	.18	.15	.16	.03	.13	.15	.17
(6)	Abil. Grouping						.09	.07	.14	.05	.10	.11	.15	.11
(7)	Indiv-Paced Learning							.33	.02	.10	.05	.09	.16	.18
(8)	Dia-Pres. Education								.06	.13	.05	.10	.13	.12
(9)	Remedial Reading-Math									.06	-.02	.06	.04	.09
(10)	Bilingual Instr.										.01	.06	.07	.15
(11)	Course-Length Alts.											.16	.18	.09
(12)	Daily Sched. Alts.												.15	.19
(13)	Grading Alts.													.16
(14)	Variety of Physical Facilities													